

CLAIMS

We Claim:

1. An antenna device for transmitting and receiving radio waves, connectable to a radio communication device, and comprising:

5 - a transmitter section and a receiver section, said receiver section including:

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- a receiving antenna structure switchable between a plurality of antenna configuration states, each antenna configuration state being distinguished by a set of radiation related parameters;

10 - a switching device capable of selectively switching said antenna structure between said plurality of antenna configuration states;

15 - a measuring device capable of receiving a first measure representing a reflection coefficient as measured at said transmitter section; and

20 - a control device capable of controlling said switching device of said receiver section, wherein said selective switching of the antenna device between said plurality of antenna configuration states is effected, in response to said first measure representing said reflection coefficient.

25 2. The antenna device as claimed in Claim 1, wherein said measuring device is capable of repeatedly receiving a first measure representing the reflection coefficient.

3. The antenna device as claimed in Claim 2, wherein said control device is adapted to control said switching device to switch between said plurality of antenna configurations states in

response to said repeatedly received first measure representing said reflection coefficient.

4. The antenna device as claimed in Claim 1, wherein each of said plurality of antenna configuration states is adapted for use of the antenna device in said radio communication device in a respective predefined operation environment.

5. The antenna device as claimed in Claim 4, wherein a first antenna configuration state of said plurality of antenna configuration states is adapted for use of the antenna device in said radio communication device in free space and a second antenna configuration state of said plurality of antenna configuration states is adapted for use of the antenna device in said radio communication device in talk position.

10. The antenna device as claimed in Claim 5, wherein a third antenna configuration state of said plurality of antenna configuration states is adapted for use of the antenna device in a radio communication device in waist position.

15. The antenna device as claimed in Claim 6, wherein a fourth antenna configuration state of said plurality of antenna configuration states is adapted for use of the antenna device in a radio communication device in pocket position.

20. The antenna device as claimed in Claim 1, wherein said antenna device is arranged for switching frequency band in response to said first received measure representing the reflection coefficient.

25. The antenna device as claimed in Claim 1, wherein said antenna device is arranged for connection and disconnection of reception diversity functionality, in response to said first received measure representing the reflection coefficient.

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10. The antenna device as claimed in Claim 1, wherein said transmitter section further includes

- a transmitting antenna structure switchable between a plurality of transmitting antenna configuration states, said plurality of transmitting antenna configuration states being distinguished by a set of radiation related parameters; and

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10 - a transmitter switching device for selectively switching said transmitting antenna structure between said plurality of transmitting antenna configuration states, wherein said control device is adapted to control said transmitter switching device of said transmitter section, and wherein said selective switching of said transmitting antenna structure between said plurality of antenna configuration states is in response to said first received measure representing the reflection coefficient.

11. The antenna device as claimed in Claim 1, wherein said control device is adapted to control at least said switching device of said receiver section to selectively switch said receiving antenna structure between said plurality of antenna configurations states in response to said first received measure representing said reflection coefficient exceeding a threshold value.

12. The antenna device as claimed in Claim 1, wherein

- said control device is adapted to control at least said switching device of said receiver section to selectively switch the receiving antenna structure through said plurality of antenna configuration states;

25 - said measuring device is adapted to receive a respective measure representing the reflection coefficient for each antenna configuration state; and

- said control device is further adapted to control said switching device of said receiver section to selectively switch said receiving antenna structure to one of said plurality of antenna configuration states with a lowest measure representing said reflection coefficient, in response to said first received measure representing a reflection coefficient exceeding a threshold value.

13. The antenna device as claimed in Claim 1, wherein said control device compares said first received measure representing said reflection coefficient with a previously received measure representing said reflection coefficient, and said control device is adapted to control at least said switching device of said receiver section to selectively switch said receiving antenna structure between said plurality of antenna configurations states in response to said comparison.

14. The antenna device as claimed in Claim 1, wherein said control device includes a look-up table with absolute or relative reflection coefficient measure ranges, each of said reflection coefficients being associated with one of said plurality of antenna configuration states, and wherein said control device is arranged to refer to said look-up table to control at least the switching device of said receiver section.

15. The antenna device as claimed in Claim 1, wherein at least said plurality of antenna configuration states comprise different numbers of connected receiving antenna elements.

16. The antenna device as claimed in Claim 1, wherein said plurality of antenna configuration states comprise differently arranged feed connections.

17. The antenna device as claimed in Claim 1, wherein at least said plurality of antenna configuration states comprise differently arranged RF ground connections.

18. The antenna device as claimed in Claim 1, wherein said control device is arranged in said receiver section.
19. The antenna device as claimed in Claim 1, wherein said control device comprises a central processing unit and a memory for storing antenna configuration data.
- 5 20. The antenna device as claimed in Claim 1, wherein said switching device comprises a microelectromechanical system (MEMS) switch device.
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- 10 21. The antenna device as claimed in Claim 1, wherein said antenna structure comprises a switchable antenna element chosen from the group consisting essentially of meander, loop, slot, patch, whip, spiral, helical and fractal configurations.
- 15 22. An antenna device as recited in claim 1, wherein said radiation related parameters include at least one of resonance frequency, input impedance, bandwidth, radiation pattern, gain, polarization and near field pattern.
- 20 23. An antenna device as recited in claim 10, wherein said radiation related parameters include at least one of resonance frequency, input impedance, bandwidth, radiation pattern, gain, polarization and near field pattern.
24. An antenna device connectable to a radio communication device, comprising:
- transmitter and receiver sections, said transmitter section including
- 25 -- an input for receiving a first RF signal from a transmitter circuitry of said radio communication device,
- a power amplifier for amplifying said received RF signal, and

- a transmitting antenna element for receiving said amplified signal and for radiating RF waves in dependence thereof; and said receiver section including

-- an antenna structure switchable between a plurality of antenna configuration states, each of said configuration states being distinguished by a set of radiation related parameters,

-- a switching device for selectively switching said antenna structure between said plurality of antenna configuration states,

-- a low noise amplifier for amplifying said received second signal, and

-- an output for outputting said amplified second signal to a receiver circuitry of said radio communication device;

- a measuring device capable of receiving a measure representing the reflection coefficient as measured at the transmitter section; and

- a control device capable of controlling the switching device of said receiver section in response to said measure representing the reflection coefficient.

25. A method for transmitting and receiving electromagnetic waves,

the method comprising:

- receiving a measure representing a reflection coefficient; and

- controlling a switching device to selectively switch an antenna structure between a plurality of antenna configuration states in response to said measure representing the reflection coefficient, each of said configuration states being distinguished by a set of radiation related parameters.,

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26. A method as recited in claim 25, wherein the set of radiation related parameters include at least one of resonance frequency, impedance, radiation pattern, polarization and bandwidth.

27. The method as claimed in Claim 25, further comprising receiving a first measure representing the reflection coefficient repeatedly.

28. The method as claimed in Claim 26, further comprising controlling said switching device to switch between said plurality of antenna configurations in response to said repeatedly received first measure representing said reflection coefficient during use of said antenna device in a radio communication device, so as to dynamically adapt said antenna device to objects in the vicinity of said radio communication device.

29. The method as claimed in Claim 25, wherein each of said plurality of antenna configuration states is adapted for use of the antenna device in said radio communication device in a respective predefined operation environment.

30. The method as claimed in Claim 25, further comprising switching frequency bands in response to said first received measure representing said reflection coefficient.

31. The method as claimed in Claim 25, further comprising connecting or disconnecting reception diversity functionality, in response to said first received measure representing the reflection coefficient.

32. The method as claimed in Claim 25, further comprising controlling the switching device of said receiver section to selectively switch said receiving antenna structure between said plurality of antenna configurations states in response to said

first received measure representing said reflection coefficient's exceeding a threshold value.

33. The method as claimed in Claim 25, in response to said first received measure representing said reflection coefficient's exceeding a threshold value, further comprising:

- controlling the switching device of said receiver section to selectively switch the receiving antenna structure through said plurality of antenna configuration states;
- receiving a respective measure representing the reflection coefficient for each antenna configuration state; and
- controlling the switching device of said receiver section to selectively switch the receiving antenna structure to the antenna configuration state with the lowest measure representing the reflection coefficient.

34. The method as claimed in Claim 25, further comprising comparing said first received measure representing said reflection coefficient with a previously received measure representing said reflection coefficient, and controlling the switching device of said receiver section to selectively switch said antenna structure between said plurality of antenna configurations states in response to said comparison.

35. The antenna device as claimed in Claim 25, further comprising storing a look-up table with absolute or relative reflection coefficient measure ranges, each of said absolute or relative reflection coefficients being associated with a respective antenna configuration state, and referring to said look-up table for controlling at least said switching device.